

CMPT 393: Midterm Exam

Nov. 3, 1999

1. You need to drive to an exam on a cold January morning, and you have a car and a truck. The car will start with probability 0.9, and the truck with probability 0.8. Hence, the probability that you get to the exam is

$$1 - (1-0.8)(1-0.9) = 0.98$$

2. If the average up time of a machine is 2 days, and its availability is 0.8, the average down time is 0.5 (solve $0.8 = 2/(2+\text{downtime})$ for downtime) 3. Suppose in a spreadsheet, the cost per order is given in B3, the cost for holding in C3, and the expected demand in D3. Cells B5 and B6 should contain, respectively, the optimal order quantity and the cost corresponding to this quantity. What formulas do you enter in

$$B5: \text{sqrt}(B3 \cdot D3 \cdot 2 / C3)$$

$$B6: \text{sqrt}(2 \cdot B3 \cdot D3 \cdot C3) \text{ or } B5 \cdot C3 / 2 + B3 \cdot D3 / B5$$

4. A company has 3 products, say product 1, 2 and 3, with quantities x_1 , x_2 and x_3 . The following restrictions are imposed by the limitations in the amount of labor and capital

$$\begin{array}{rcl} 3x_1 & + & 4x_2 + 2x_3 = 6 \quad \text{labor} \\ 2.5x_1 & + & 2x_2 + x_3 = 4 \quad \text{capital} \end{array}$$

Moreover, the profit is given as

$$4x_1 + 3x_2 + 2x_3$$

The final tableau looks as follows

c_j	basis	x_1	x_2	x_3	s_1	s_2	quant
2	x_3		2	1	1.25	-1.5	1.5
4	x_1	1			-0.5	1	1
	Z_j	4	4	2	0.5	1	7
	$C_j - Z_j$	0	-1	0	-0.5	-1	

a) Fill in the Z_j and the $C_j - Z_j$

b) Find the quantities for x_1 , x_2 and x_3 .

$$x_1 = 1 \quad x_2 = 0 \quad x_3 = 1.5$$

c) Find the quantities for x_1 , x_2 and x_3 , given the right-hand side of the labor restriction is increased from 6 to 6.4

$$x_1 = 1 + 0.4 \cdot (-0.5) = 0.8 \quad x_2 = 0 \quad x_3 = 1.5 + 0.4 \cdot 1.25 = 2$$

5. A farmer has two different pieces of land with different moisture content. On the first piece of land, he expects that he will harvest 30 bbl of wheat per acre, and on the second, 28 bbl. He can also plant

canola. The canola yield on the first piece of land is 28 bbl per acre, and the yield on the second piece of land is 31 bbl per acre. The first piece of land is 1000 acres, and the second 800 acres. Net revenues for wheat are \$2/bbl, and for canola, \$2.10. However, the bins are limited in capacity to 40000 for wheat and 35000 for canola. However, wheat can be stored in temporary facilities, but because of the loss in grade, the net revenue for this wheat is only \$1.50. Formulate the problem as a linear programming problem, but do not solve it.

x_{1w} : acreage of wheat in field 1
 x_{1c} : acreage of canola in field 1
 y : amount which goes on temporary storage

Objective

$$2(30 x_{1w} + 28 x_{2w} - y) + 2.1 (28x_{1c} + 31 x_{2c}) + 1.5 y$$

land restriction

$$x_{1w} + x_{1c} \leq 1000$$

$$x_{2w} + x_{2c} \leq 800$$

storage restriction

$$30 x_{1w} + 28 x_{2w} - y \leq 40000$$

$$28 x_{1c} + 31 x_{2c} \leq 35000$$



Please report any problems with this document to grassman@cs.usask.ca